Studies in Laguna Beach *Isopoda,* II

BLANCHE E. STAFFORD, M.S.

Nearly everyone who frequents the seashore and is half alive to the many opportunities which the water, rocks and sand offer in a study of the manifestations of life which they can reveal, has become acquainted with the form and habits of such crustaceans as the lobsters, crabs and shrimps. There are very few, also, who do not know the lively little sand-fleas which populate so thickly the sandy beach. Not many realize, however, that these latter are relations of the big lobster and crab, as they are, and that they are of myriad forms and habits; that they live not alone in the sand, but in the shallow pools, under rocks, on the sea mosses and in the deep waters. But still less do they know of the Isopoda, the near neighbors of the sand fleas, or Amphipoda. It is with certain Isopoda, relatives of the lobster and crab and sand-flea, that this paper deals. The reason we know so little, as casual observers, of these little creatures is that they are very secretive and love to hide themselves in obscure places; their characteristic manner of crawling, instead of hopping as do the Amphipoda, makes them less conspicuous than the latter. But they are in reality very numerous and most interesting in the variety of forms they exhibit. To know them one has only to catch them at the proper time and place and to ferret them out of their retreats. Frequent the beach at a time when the tide is fast advancing and you will see along the line left by the receding water whole hosts of these little crawlers, scurrying out of their holes for the high and dry sands. Go in the very early morning when the tide is at its lowest mark to the mossy rocks which lie uncovered then. As you turn them over one by one you will find many interesting things, among them numbers of amphipods that slide around on their sides, and a great plenty of very active isopods. You may gather some of the moss on the rocks and with the help of a hand lens find that it is peopled with minuter forms which you cannot see without this careful scrutiny. And

there are still many other places in which some one or another of this isopod group dwells. Some are securely fortified within the minute chambers of the sponges; some are tube builders or excavators; some have sought the crevices of the big dry rocks where they neighbor with the shore crabs; and some are even fond of the muddy shore of a stagnant lagoon; still others inhabit the gill chambers of fish or crabs, living a parasitic and degenerate life. Though many of the Isopoda are marine there are also many terrestrial and fresh-water forms, the former known to most of us by their representative, the common sow-bug, or wood-louse, or pill-bug, as it is variously called.

Not less interesting than the numbers and habitat of these animals is their diversity in color and form as adapted to their environment. Those inhabiting the sandy and rocky places are provided with a chitinous crusty structure and are colored a dull gray or brown which favors well their characteristic love for obscurity. Those which dwell in the pools or on the moss are more delicate and are provided with special swimming organs. On the green Algæ there are elongated isopods, green in color and hardly distinguishable from the moss on which they occur, and similarly brown forms on the brown Algæ. A most interesting instance of these color adaptations which I observed in my study at Laguna Beach was that of an isopod which dwells on the oral surface of a sea urchin; it was a dark reddish-purple in color, so very like that of its host that one could scarcely distinguish it when at rest. Much might be said of the diversity and beauty of color of the marine Isopoda, but that is a study in itself.

It appears that the Isopoda and Amphipoda are somewhat closely related, since both can be grouped under the more limited division, Arthrostraca. They differ from each other as follows: the Isopoda are dorso-ventrally flattened, the Amphipoda laterally compressed. There are other differences such as modified second and third thoracic appendages and a differentiation of abdominal segments into two sets in the Amphipoda. A common and popular distinction is the crawl-

ing habit of the isopod and the hopping habit of the Amphipoda. Such a distinction is not entirely valid however, since neither of these characteristics is common to all the forms of either group.

The Isopoda body is differentiated into: (1), a head having sessile, usually compound eyes which may be contiguous or distant; antennæ of two pairs, generally; a set of delicate mouth parts, consisting of an upper and lower lip, two pairs of maxillæ, a pair of mandibles and a pair of maxillipeds; (2), a thorax of seven segments of similar structure, each bearing a pair of legs; the legs are often similar, a characteristic which led Latreille to name them Isopoda from two Greek words meaning "equal" and "foot". Latreille, however, was not acquainted with the many exceptional forms such as the modified first leg for grasping purposes or the posterior swimming legs found in some species; (3), an abdomen consisting usually of six segments, five of which bear pleopods (respiratory and natatory organs); the sixth with a pair of uropoda (natatory organs). The Isopoda do not develop through a series of larval stages but through direct development. The females are provided with marsupial plates which form a brood pouch in the sexually mature individual.

After a careful study of the complicated and finely adjusted structure of these creatures one must have gained a great respect for them and for the complete and perfect results which nature has here effected. Add to this study a knowledge of the actual service rendered by the Isopoda in the economy of nature and one's interest in them will be increasingly greater. Have you ever stopped to consider how very rich in life the sea is, with its multitudes of marine plants and animals? Have you further considered how many of these forms are constantly being destroyed in one way or another and subject to the processes of decay? If so, you have often wondered how the sea is kept ever sweet and pure. For a solution, in part, of this question I would ask you to turn to the isopods and their associates, the amphipods. These small animals, many of them almost microscopic in size, are the scavengers of the waters and it

is their service to remove the waste of ocean life. The latter are free swimmers and in their wanderings scour the surface of the waters. The former usually remain close in their native haunts and it is they who purify the substrata of the sea. Not here does their service end. So abundant are they that they form a part of the food of many fish and thus they are indirectly food providers for men. To these ends the Isopoda are very widely distributed. They are most abundant in the northern waters. Thence they extend in varying numbers to the warm southern waters and the temperate shores and from east to west. So great is their importance that we dare not speculate as to the state of unstable equilibrium in nature which their sudden and thorough destruction would cause. Suffice it to say, that at present no such calamity is pending, for the isopods are a mighty throng and well equipped by nature to survive.

In the studies which follow I have described and illustrated twelve species collected at Laguna Beach, California, in the summer of 1911. One of these is a new species, two are new varieties. A number of the others, although noted before, have not been illustrated at all before or if so not at all completely.

List of the Species Represented in this Study

Superfamily FLABELLIFERA

A. Family CIROLANIDÆ
Genus *Cirolana*

Cirolana harfordi (Lockington)

B. Family SPHÆROMIDÆ
Genus *Dynamene*

Dynamene glabra Richardson

Superfamily VALVIFERA

A. Family IDOTHEIDÆ
a. Genus *Idothea*

Idothea rectilinea (Lockington)

b. Genus *Pentidotea*

Pentidotea aculeatus n. sp.

Superfamily ASELLOTA

B. Family JANIRIDÆ

a. Genus *Janira*

Janira occidentalis Walker

Superfamily ONISCOIDEA

A. Family TYLIDÆ

a. Genus *Tylos*

Tylos punctatus Holmes and Gay

B. Family ONISCIDÆ

a. Genus *Alloniscus*

Alloniscus cornutus var. *lagunae* n. var.

Alloniscus perconvexus (Dana)

b. Genus *Philoscia*

Philoscia richardsonae Holmes and Gay

Cirolana harfordi (Lockington)

(Figs. 1, 2, and 3)

Locality—Very abundant under rocks between tides, at Laguna Beach, California.

Color—Great variation, some white with gray markings, some shaded with yellow or orange; females bearing eggs often show a bright red coloration; in alcohol the specimens always appear to be a sordid white marked with gray.

Body ovate, arched transversely and longitudinally. Specimen described measures 7 mm. by 3 mm. Head wider than long, 2 mm. by 1 mm.; rounded on anterior margin. Eyes small, composite, situated laterally and touch anterior margin of first thoracic segment. First pair of antennæ have a peduncle of three articles of which the first and second are small and subequal; third almost as long as first and second and narrower; flagellum of ten articles. Second pair of antennæ have a peduncle of five articles: first three small and subequal;

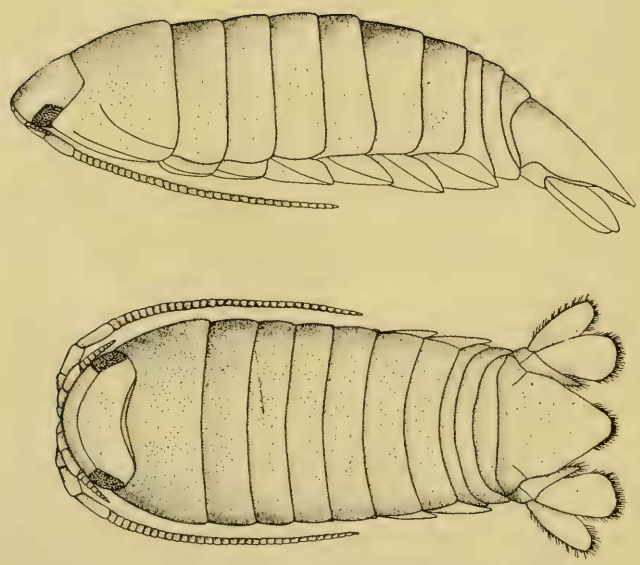

Figure 1. *Cirolana harfordi* (Lockington). Lateral and dorsal views.

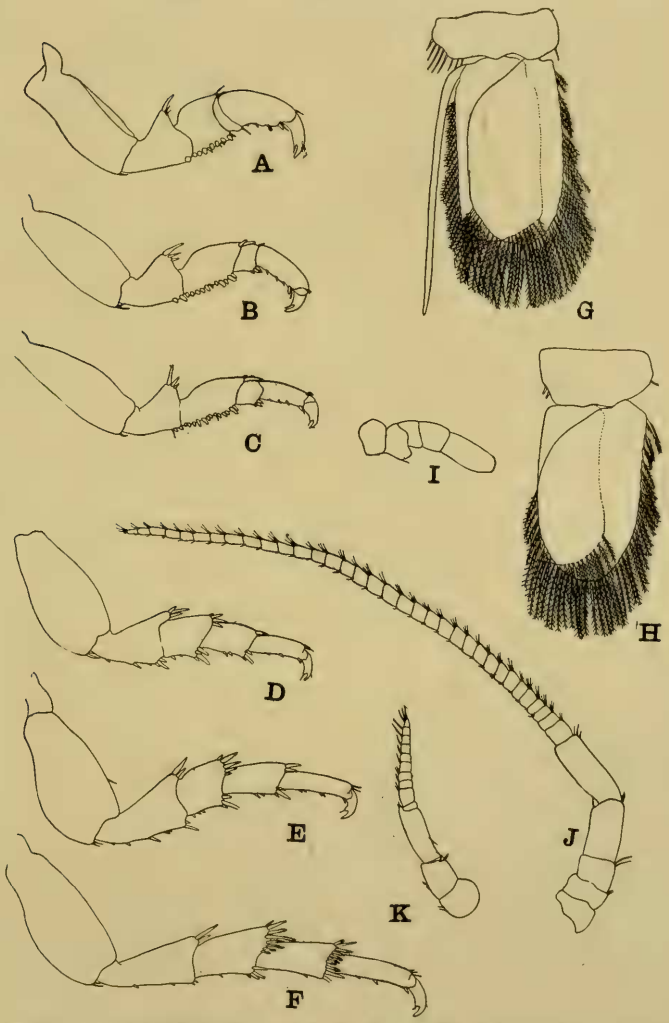

Figure 2. *Cirolana harfordi* (Lockington). A, first leg; B, second leg; C, third leg; D, fourth leg; E, fifth leg; F, seventh leg; G, second pleopod of male; H, first pleopod of male; I, frontal lamina and basal joints of antennæ; J, second antennæ; K, first antennæ.

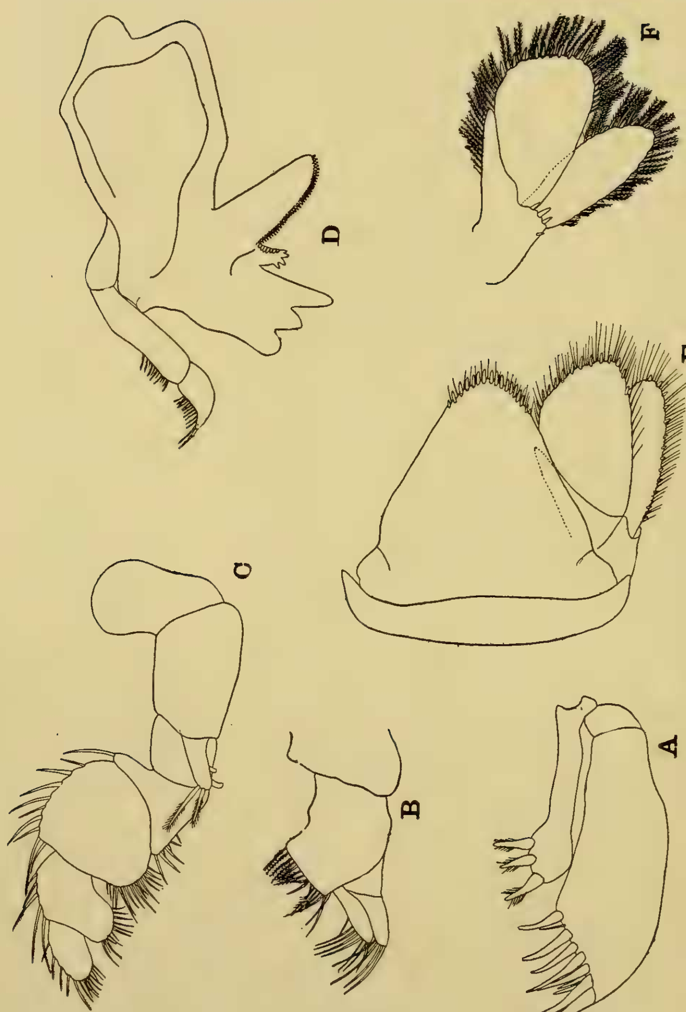

Figure 3. *Cirolana harfordi* (Lockington). A, first maxilla; B, second maxilla; C, maxilliped; D, mandible; E, telsen; F, uropod.

fourth about twice as long as wide, about as long as second and third; fifth about one-fourth longer than fourth; flagellum multiculate, thirty-four articles. First antennæ extend to end of peduncle of second antennæ; the latter extend to end of fifth thoracic segment. Maxilliped composed of seven articles; the last four very plumose; third is provided with two hoops or blunt spines. Mandible carries a palp of three articles and a toothed molar. Frontal lamina, distinct, short and broad, anterior margin triangulate though not sharply so.

First segment of thorax large, twice as long as third and fourth segments. Succeeding segments almost equal in length, though second is very slightly longer than third and fourth. Epimera are very distinct on all but first segment. Last four are produced at post-lateral angles especially the sixth and seventh. A carina is apparent on all the epimera, longitudinal in the first two and oblique in the last four. First three legs prehensile, remaining ambulatory. On propodus of first there are three prominent spines; one on the carpus; on the merus seven prominent blunt spines and about three sharp ones; ischium has one blunt spine like those of the merus, also a large spine on the outer distal margin. Second leg has three or four spines on the propodus; three on the carpus; eleven blunt spines on the merus and two spines on outer distal margin; ischium has two blunt spines, one large and two small ones on outer distal margin. Ambulatory legs provided with many robust spines.

Abdomen in the specimen described shows only three segments, four or five may be visible, however, but first is usually concealed. Sixth broad at proximal end, attenuated posteriorly; apex rounded, provided with many strong spines, twelve to twenty-two. Inner branch of uropoda as long as terminal abdominal segment; broad at distal end where it is armed with spines. Outer branch is shorter than inner and narrower; also armed with spines on distal end and outer margin. Peduncle of uropoda produced to two-thirds length of inner ramus. First and second pleopoda of male provided with many compound hairs; second has a long stylet.

Alloniscus cornutus var. *lagunae* n. var.

(Figs. 4 and 5)

Locality—Margins of stagnant salt lagoon; under old sea-weed where it is associated with *Philoscia richardsonae* Holmes and Gay, at Laguna Beach, California.

Color—Dull gray-brown, resembling the old sea-weed under which it lives.

Body convex, ovate and punctate; about 10 mm. long and 5 mm. wide, 3 mm. high (dimensions of a large specimen).

Figure 4. *Alloniseus cornutus* var. lagunæ n. var.

Head not closely articulated with thorax; frontal margin produced medially into a prominent lobe; antero-lateral angles form distinct processes, much more prominent than in *Alloniscus perconvexus*. Eyes oval compound, longer than wide; near lateral margin. First antennæ have three articles, which are very small, rudimentary. Second antennæ extend about as far as second thoracic segment; have a peduncle of six articles and

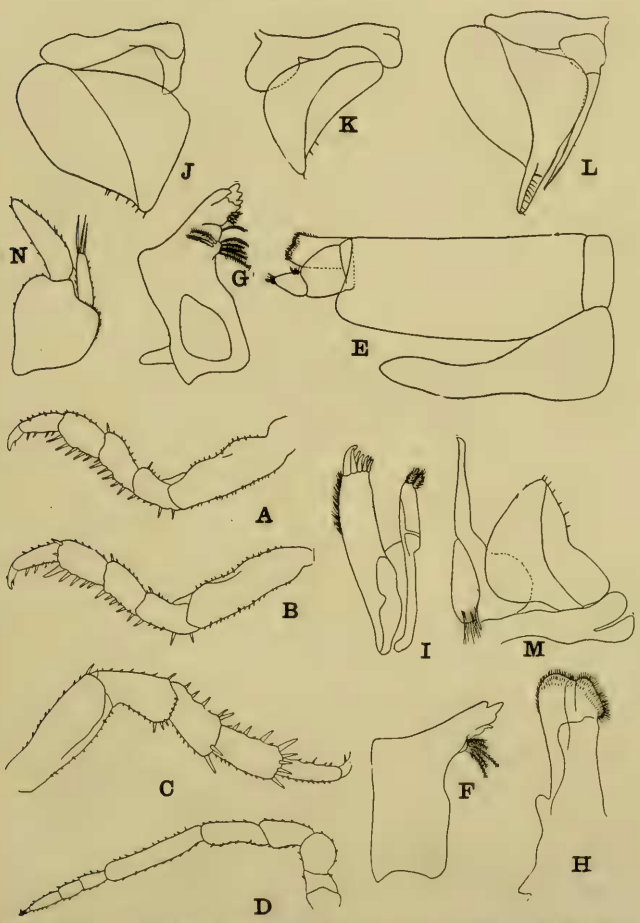

Figure 5. *Alloniscus cornutus* var. lagunæ n. var. A, first leg; B, second leg; C, seventh leg; D, second antennæ; E, maxillipeds; F and G, mandible; H, second maxilla; I, first maxilla; J, second pleopod of female; K, first pleopod of female; L, second pleopod of male; M, first pleopod of male; N, uropod.

a flagellum of three; flagellum about as long as fifth article of peduncle. Maxilliped has a palp of three articles.

The thoracic segments show no sinuations as described in *Alloniscus cornutus*. Epimeral sutures are only faintly indicated in some of the specimens on the second, third and fourth segments. Legs similar in structure and very much spined.

Abdomen has six segments; first two covered laterally by seventh thoracic segment. Epimera of third, fourth and fifth, large, extended posteriorly; subtetragonal in shape. Sixth, triangular, rounded posteriorly. Uropoda have basal article broad and depressed; outer ramus twice as long as inner which articulates at the inner angle of the basal article and is concealed at articulation by last abdominal segment. The outer ramus does not appear to be carinated.

These specimens evidently lie close to *Alloniscus cornutus*. Their peculiar habitat and associations should be significant. As the specific habitat of *A. cornutus* is not given it is impossible to compare them on this point. However, *A. cornutus* is described as having sinuated thoracic margins. Such is not the case with these specimens. The outer ramus of the uropoda does not appear to be carinated in this isopod as in *A. cornutus*. The flagellum of the second antennæ of the latter is shorter than the fifth article of peduncle, several specimens of this variety were examined and the flagellum appears about equal, scarcely less than fifth article. Accordingly I have made these specimens, provisionally, a variety of *A. cornutus*.

(Continued in the next number of the Journal)